

TFT Product Specification

- ◇ PRELIMINARY SPECIFICATION
- ◆ APPROVED SPECIFICATION

Part Number: FLD-156ITL20PUSA2

Description: TFT 15.6''W 1366*768 LVDS 500CD assemble Pcap 3mm Black USB

Prepared by: Joy

Version : 0.2

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| | |
|-------------|--|
| | |
| Approved by | |
| Date | |

Revision History

| Version | Date | Page | Description | Note |
|---------|-----------|------|----------------|------|
| V0.1 | 2018/3/16 | | First Edition | |
| V0.2 | 2018/4/18 | | Adjust Grafich | |
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A. LCD specification

1. GENERAL DESCRIPTION

1.1 Description

15.6" is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The screen format is intended to support WXGA 1366x768 screen and 16.7M colors.

1.2 Product Summary

The following items are summary on the table under Ta=25 °C condition:

| No. | Item | Specification | Unit |
|-----|-------------------------|------------------------------------|-------------------|
| 1 | Display Size | 15.6 | Inch |
| 2 | Pixel Number | 1366 (H) x RGB x 768 (V) | Pixels |
| 3 | Outline Dimension | 363.80 (H) x 215.98 (V) x 9.30 (D) | mm |
| 4 | Active Area | 344.23 (H) x 193.54 (V) | mm |
| 5 | Display Colors | 16.7M | -- |
| 6 | Pixel Arrangement | RGB vertical stripe | -- |
| 7 | Display Mode | Normally White / Transmissive | -- |
| 8 | Electrical Interface | LVDS | -- |
| 9 | Surface Treatment | Anti-Glare, 3H | -- |
| 10 | Original TFT Brightness | 500 (Typ.) | cd/m ² |
| 11 | Contrast Ratio | 600 (Typ.) | -- |
| 12 | Power Consumption (Typ) | Total 12.1 | W |
| 13 | Operating Temperature | -10 ~ 60 | °C |
| 14 | Storage Temperature | -20 ~ 60 | °C |



2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

| Item | Symbol | Values | | | Unit | Note |
|----------------------|---------|--------|------|------|------|--|
| | | Min | Typ | Max | | |
| Power supply voltage | VCC | -0.3 | - | 6 | V | (1) |
| Logic Input Voltage | VIN | -0.3 | - | 4 | V | |
| Converter Voltage | LED_Vin | 0 | 12.0 | 18.0 | | Duty=100% (1)(2) |
| Enable Voltage | LED_EN | 0 | 3.3 | 7 | V | |
| Backlight Adjust | LED_PWM | 0 | 3.3 | 7 | V | Pulse width \leq 10msec. and duty \leq 10% |

Note (1) Permanent damage to the device may occur if max values are exceeded. Function operation should be restricted to the conditions described under normal operating conditions.

(2) Specified values are for input pin of LED light bar at Ta=25+/-2°C

2.2 Environment Absolute Rating

| Item | Symbol | Values | | | Unit | Note |
|-----------------------|------------------|--------|-----|------|------|---------|
| | | Min | Typ | Max. | | |
| Operating Temperature | T _{op} | -10 | | 60 | °C | Ta=25°C |
| Storage Temperature | T _{stg} | -20 | | 60 | °C | |

Note (1) Temperature and relative humidity range is shown in the figure below,

- (a) 90% RH Max.. (Ta<40°C)
- (b) Wet-bulb temperature should be 39°C Max. (Ta<40°C)
- (c) No condensation

(2) The temperature of panel surface should be 0°C min. and 65°C max.

3. ELECTRICAL CHARACTERISTICS

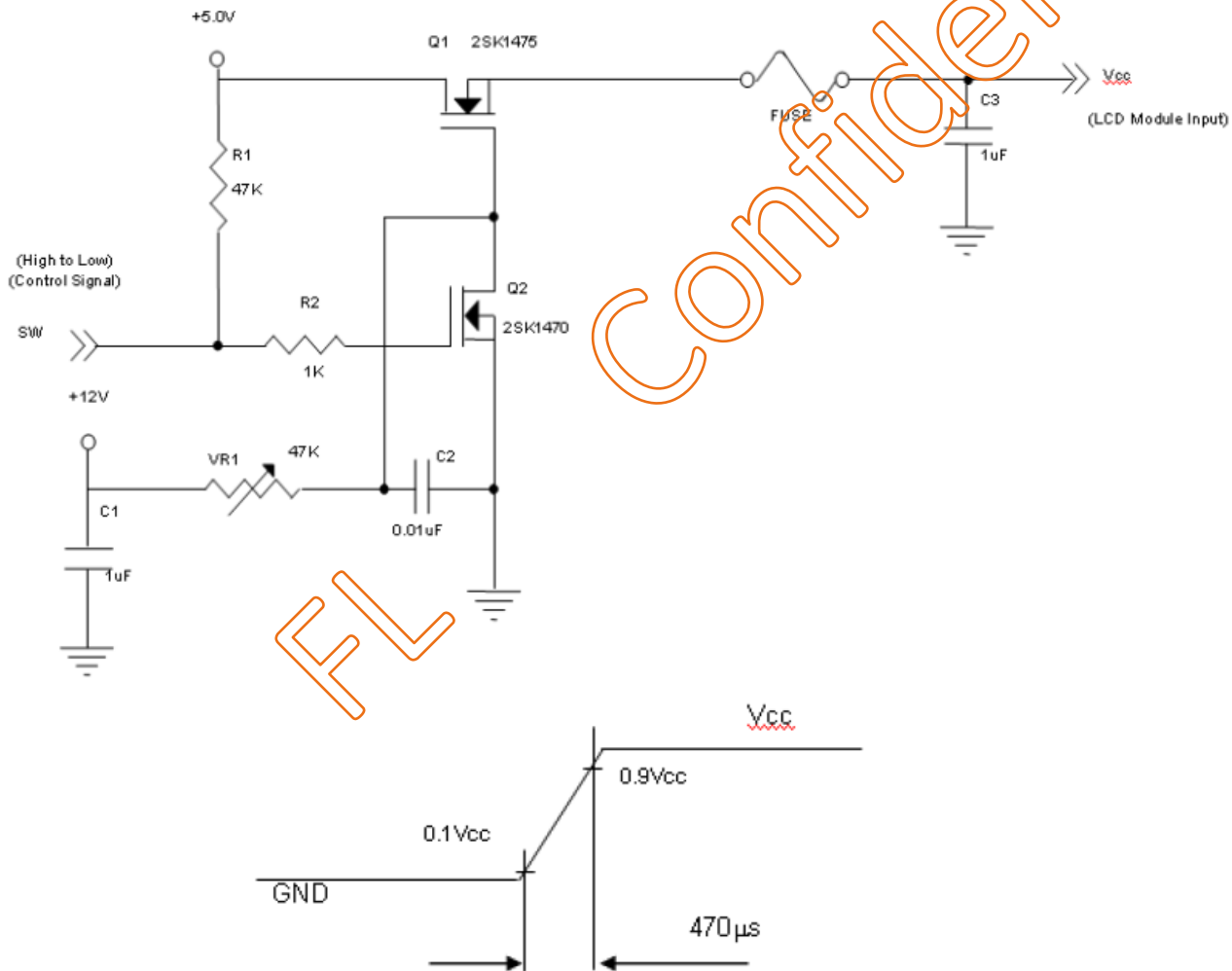
3.1 LCM

| Parameter | Symbol | Value | | | Unit | Note |
|---------------------------------|-------------------|-------|------|------|------|------|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | VCC | 4.5 | 5 | 5.5 | V | |
| Ripple Voltage | VRP | -- | -- | 150 | mV | |
| Rush Current | I _{RUSH} | -- | -- | 3.0 | A | (2) |
| Power Supply Current | White | -- | 0.17 | 0.22 | A | (3) |
| | Black | -- | 0.24 | 0.29 | A | |
| | Vertical Stripe | -- | 0.27 | 0.32 | A | |
| Power Consumption | P _{LCD} | -- | 1.35 | 1.6 | W | |
| LVDS differential input voltage | V _{id} | 200 | -- | 600 | mV | - |
| LVDS common input voltage | V _{ic} | 1.0 | 1.2 | 1.4 | V | - |
| Terminating Resistor | R _T | | 100 | | Ohm | |

Note (1) The assembly should be always operated within above ranges.

T_a = 25 ± 2 °C

Note (2) Measurement Conditions:



Note (3) The specified power supply current is under the conditions at $V_{cc}=5V$, $F_r=60Hz$, whereas a power dissipation check pattern below is displayed

a. White Pattern



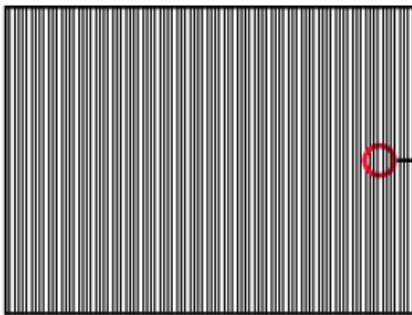
Active Area

b. Black Pattern



Active Area

c. Vertical Stripe Pattern

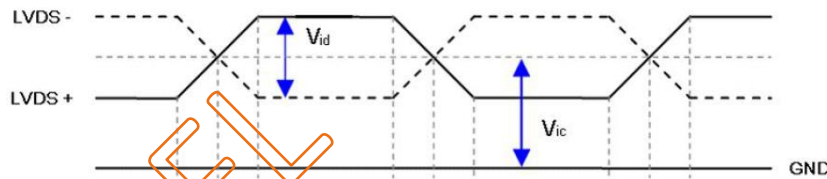


Active Area

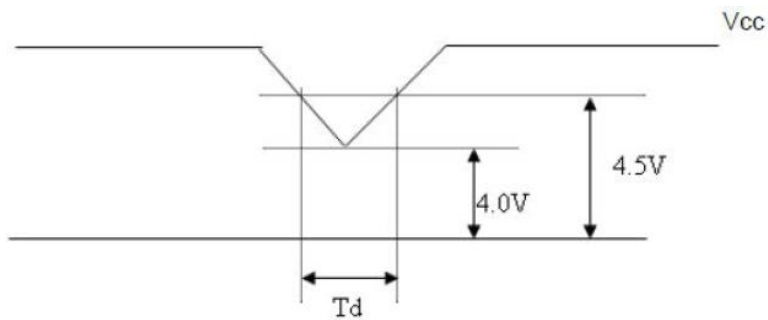


Note (4) The power consumption is specified at the pattern with the max. current.

Note (5) VID waveform condition



Note (6) Power Dip condition



Dip condition: $4.0 \leq V_{cc} \leq 4.5$, $T_d \leq 20ms$

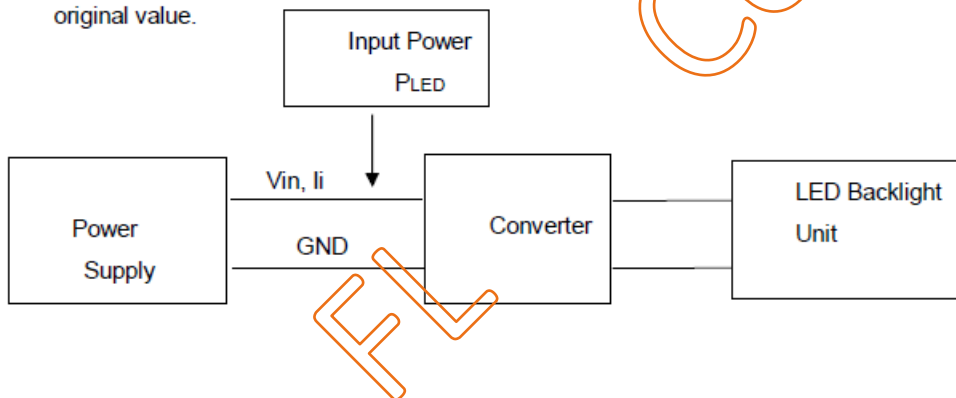
3.2 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25°C (Room Temperature):

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Note | |
|------------------|--------------------------------|----------------|------|------|------|-------------------------|--|
| LED_Vin | Converter Power Supply Voltage | 10.8 | 12.0 | 13.2 | V | | |
| Ii | Converter Power Supply Current | 0.6 | 0.8 | 1.0 | A | @LED_Vi=12V (Duty 100%) | |
| P _{LED} | BLU Power consumption | -- | -- | 10.5 | W | @LED_Vi=12V (Duty 100%) | |
| LED_EN | EN Control Level | Backlight on | 2.0 | 3.3 | 5.0 | V | |
| | | Backlight off | 0 | 0 | 0.8 | V | |
| LED_PWM | PWM Dimming Control Level | PWM High Level | 2.0 | 3.3 | 5.0 | V | |
| | | PWM Low Level | 0 | 0 | 0.15 | V | |
| | PWM Dimming Control Duty Ratio | 10 | -- | 100 | % | | |
| f _{PWM} | PWM Dimming Control Frequency | 190 | 200 | 20K | Hz | | |
| LL | LED life Time (Typical) | 50,000 | -- | -- | Hrs | (2) | |

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below.

Note (2) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and $I = 70 \text{ mA}$ (per chip) until the brightness becomes $\cong 50\%$ of its original value.



4. SIGNAL CHARACTERISTICS

4.1 Interface Timing

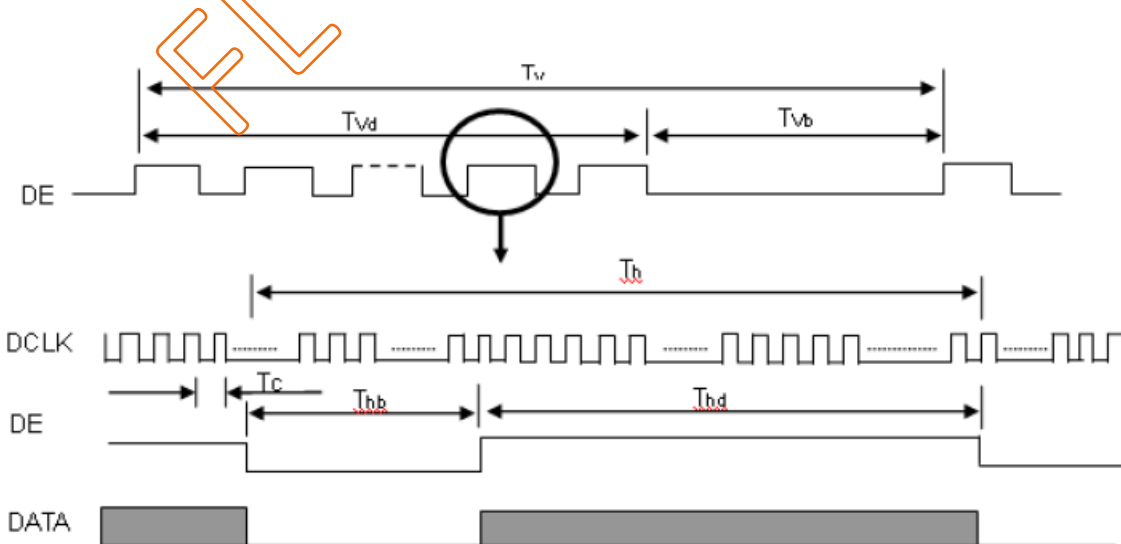
4.1.1 Timing Characteristics:

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------------|--------------------------------------|-----------------------------------|----------------------|-------|----------------------|----------------|--|
| LVDS Clock | Frequency | F _c | 63 | 76 | 96 | MHZ | |
| | Period | T _c | -- | 13.15 | -- | ns | |
| | Input cycle to cycle jitter | Trcl | -0.02*T _c | -- | 0.02*T _c | ns | (3) |
| | Input Clock to data skew | TLVCCS | -0.02*T _c | -- | 0.02*T _c | ps | (4) |
| | Spread spectrum modulation range | F _{clk_{in}_mod} | F _c *98% | -- | F _c *1.02 | MHZ | (5) |
| | Spread spectrum modulation frequency | F _{SSM} | -- | -- | 200 | KHz | |
| Vertical Display Term | Frame Rate | Fr | 50 | 60 | 76 | Hz | T _v =T _{vd} +T _{vb} |
| | Total | T _v | 800 | 806 | 815 | Th | -- |
| | Display | T _{vd} | 768 | 768 | 768 | Th | -- |
| | Blank | T _{vb} | 32 | 38 | 47 | Th | -- |
| Horizontal Display Term | Total | T _h | 1500 | 1560 | 1570 | T _c | T _h =T _{hd} +T _{hb} |
| | Display | T _{hd} | 1366 | 1366 | 1366 | T _c | -- |
| | Blank | T _{hb} | 134 | 194 | 204 | T _c | -- |

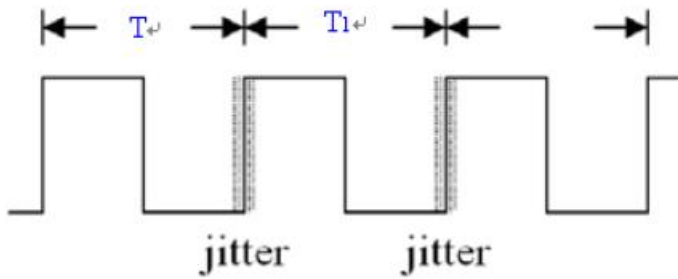
Note (1) Because this module is operated by DE only mode. Hsync and Vsync input signals are ignored.

Note (2) The T_v must be integer, otherwise, this module would operate abnormally.

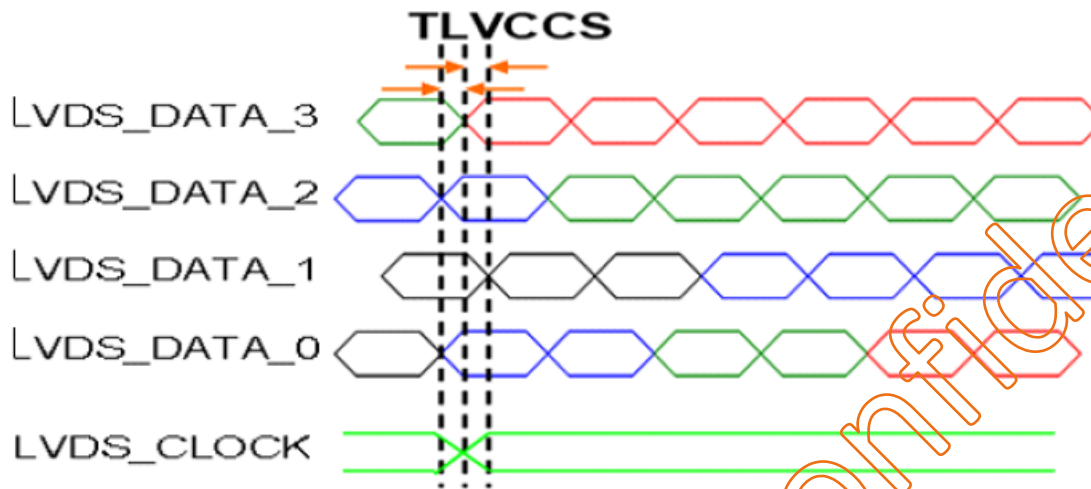
INPUT SIGNAL TIMING DIAGRAM



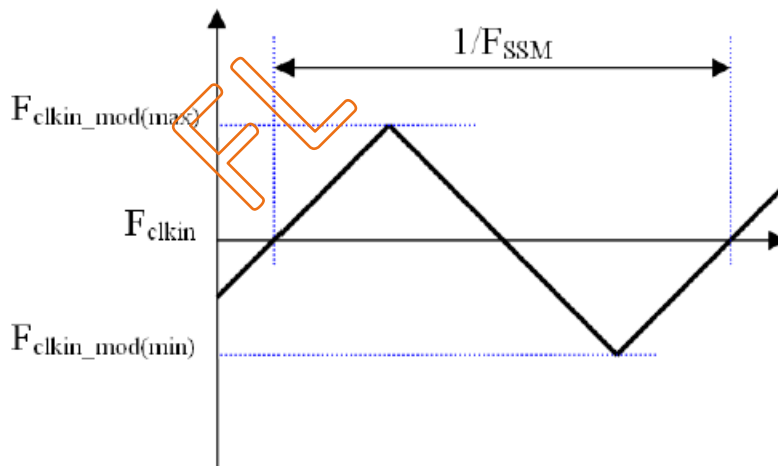
Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T1 - T|$



Note (4) Input Clock to data skew is defined as below figures.

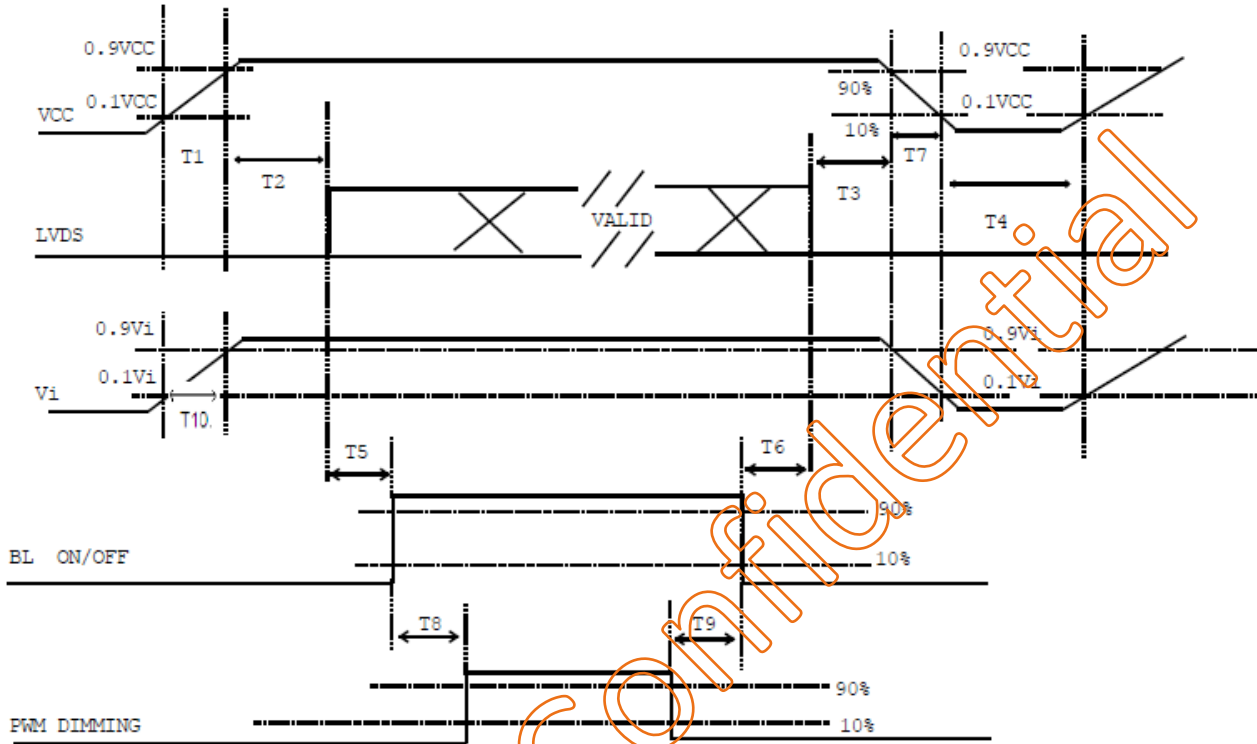


Note (5) The SSCG (Spread spectrum clock generator) is defined as below figures.



4.1.2 Power ON/OFF Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



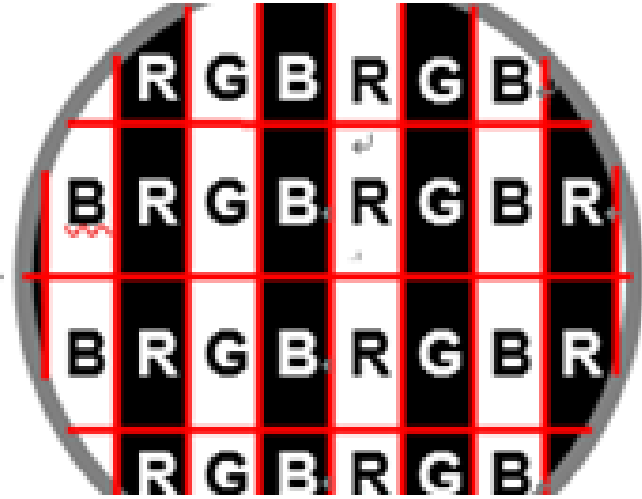
Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

| Parameter | Value | | | Units |
|-----------|-------|-----|-----|-------|
| | Min | Typ | Max | |
| T1 | 0.5 | - | 10 | ms |
| T2 | 0 | - | 50 | ms |
| T3 | 0 | - | 50 | ms |
| T4 | 500 | - | - | ms |
| T5 | 200 | - | - | ms |
| T6 | 20 | - | - | ms |
| T7 | 5 | - | 300 | ms |
| T8 | 10 | - | - | ms |
| T9 | 10 | - | - | ms |
| T10 | 20 | -- | -- | ms |

4.2 Pixel Format Image



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5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

| | Symbol | Description | Note |
|----|--------|---|------|
| 1 | NC | No Connection | - |
| 2 | NC | No Connection | - |
| 3 | NC | No Connection | - |
| 4 | GND | Ground | - |
| 5 | RX0- | Negative LVDS differential data input Channel0 | - |
| 6 | RX0+ | Positive LVDS differential data input Channel0 | - |
| 7 | GND | Ground | - |
| 8 | RX1- | Negative LVDS differential data input Channel 1 | - |
| 9 | RX1+ | Positive LVDS differential data input Channel 1 | - |
| 10 | GND | Ground | - |
| 11 | RX2- | Negative LVDS differential data input Channel 2 | - |
| 12 | RX2+ | Positive LVDS differential data input Channel 2 | - |
| 13 | GND | Ground | - |
| 14 | RXCLK- | Negative LVDS differential clock input | - |
| 15 | RXCLK+ | Positive LVDS differential clock input | - |
| 16 | GND | Ground | - |
| 17 | RX3- | Negative LVDS differential data input Channel 3 | - |
| 18 | RX3+ | Positive LVDS differential data input Channel 3 | - |
| 19 | GND | Ground | - |
| 20 | NC | No Connection | - |
| 21 | NC | No Connection | - |
| 22 | NC | No Connection | - |
| 23 | GND | Ground | - |
| 24 | GND | Ground | - |
| 25 | GND | Ground | - |
| 26 | Vcc | +5V power supply | - |
| 27 | Vcc | +5V power supply | - |
| 28 | Vcc | +5V power supply | - |
| 29 | Vcc | +5V power supply | - |
| 30 | Vcc | +5V power supply | - |

Note (1) Connector Part no.: MSCK2407P30.D(STM)

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

5.2 Backlight and LED Driver Connector PIN Assignment

| Pin No | Symbol | Description | Remark |
|--------|------------------|-------------------------|---|
| 1 | Vi | Converter input voltage | 12V |
| 2 | V _{GND} | Converter ground | Ground |
| 3 | EN | Enable pin | 3.3V |
| 4 | ADJ | Backlight Adjust | PWM Dimming (Hi: 3.3V _{DC} , Lo: 0V _{DC}) |
| 5 | NC | Not Connect | |

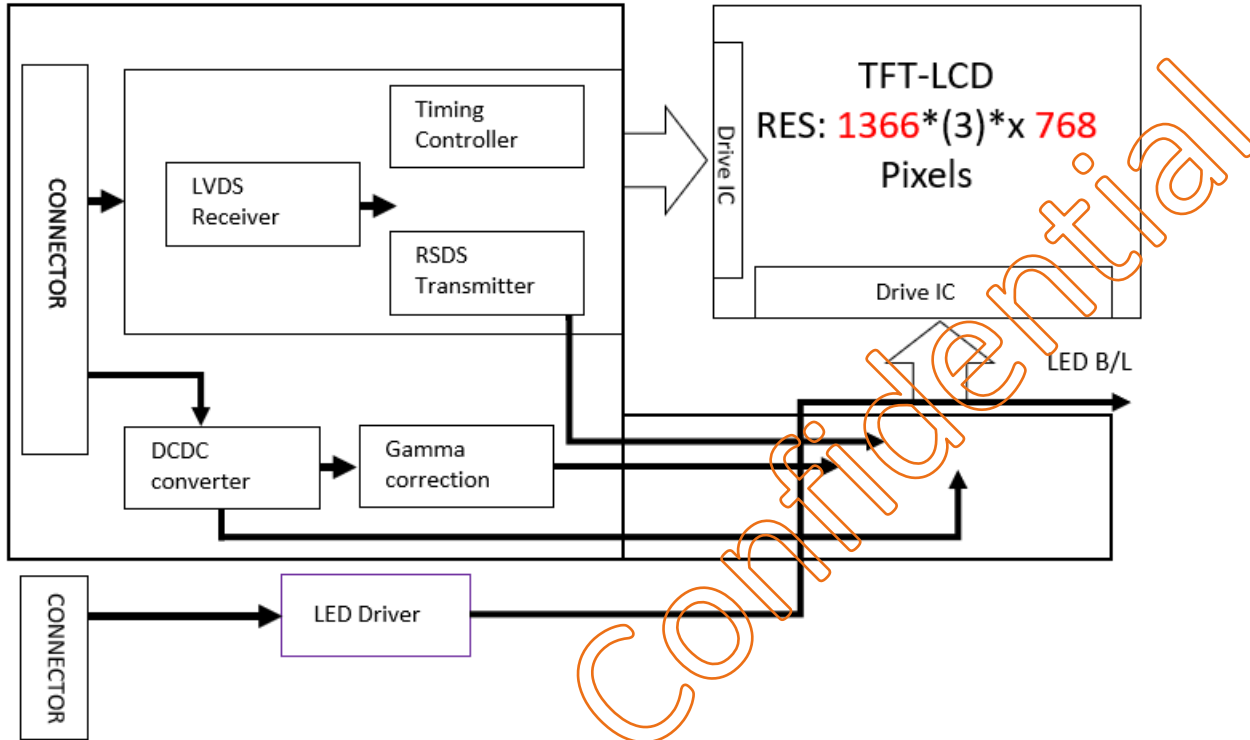
Note (1) Connector Part No.: CI4205M2HRP-NH, CVILUX

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6. BLOCK DIAGRAM

The following diagram shows the functional block of the TFT module:



7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature.

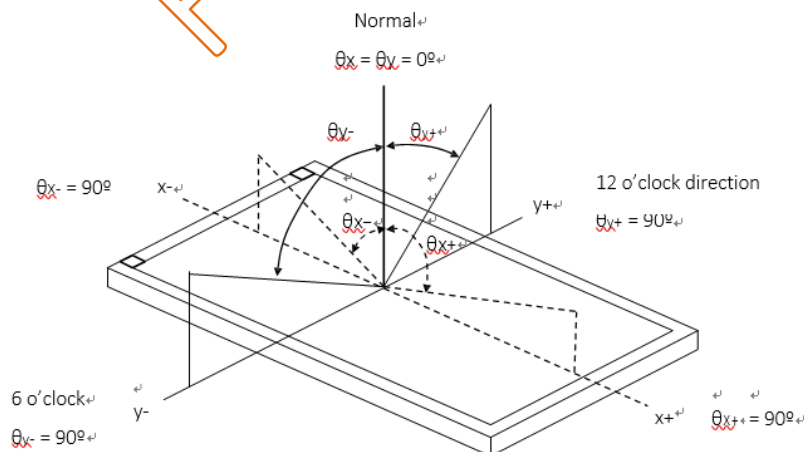
| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | | |
|---------------------------|------------|---------------|---|---|------|--------|-------------------|--------|------------|---|
| Contrast Ratio | | CR | $\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction | 400 | 600 | - | - | (2)(5) | | |
| Response Time | | T_R | | - | 3 | 8 | ms | (3) | | |
| | | T_F | | - | 8 | 13 | ms | | | |
| Center Luminance of White | | LC | | 400 | 500 | - | cd/m ² | (4)(5) | | |
| White Variation | | δW | | 70 | -- | -- | % | (5)(6) | | |
| Chromaticity | Red | R_x | | $\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction | Typ. | -0.045 | Typ. | +0.045 | (1) (5) | |
| | | R_y | 0.627 | | | | | | | - |
| | Green | G_x | 0.339 | | | | | | | - |
| | | G_y | 0.328 | | | | | | | - |
| | Blue | B_x | 0.590 | | | | | | | - |
| | | B_y | 0.160 | | | | | | | - |
| | White | W_x | 0.063 | | | | | | | - |
| | | W_y | 0.313 | | | | | | | - |
| Viewing Angle | Horizontal | θ_{x+} | 70 | 80 | - | Deg. | (1)(5) | | | |
| | | θ_{x-} | 70 | 80 | - | | | | | |
| | Vertical | θ_{y+} | 65 | 75 | - | | | | | |
| | | θ_{y-} | 65 | 75 | - | | | | | |

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance <2 lux, and at room temperature).

The ambient temperature is $25^\circ\text{C} \pm 2^\circ\text{C}$ and ambient humidity is $50 \pm 10\% \text{RH}$.

Note 1: Definition of Viewing Angle

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or the vertical clock direction with respect to the optical axis which is normal to the LCD surface

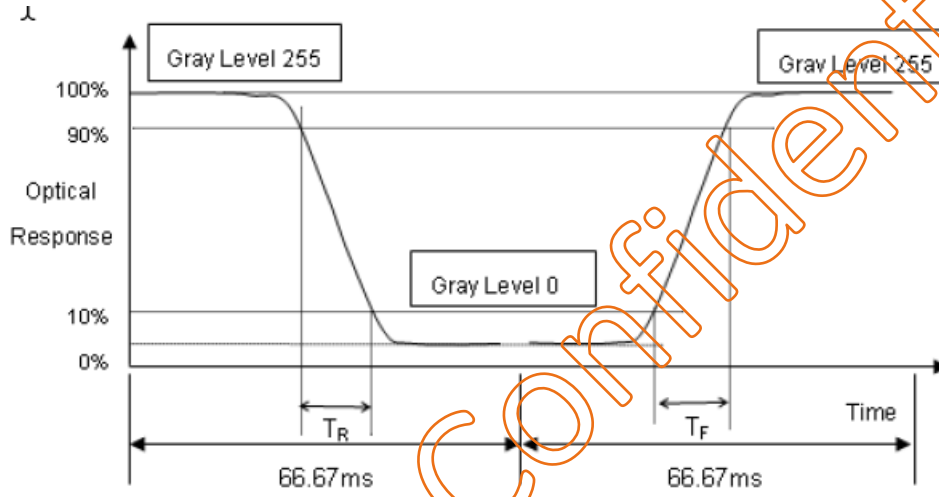


Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance with all pixels in white state divide by Luminance with all pixels in Black state

Note 3 Definition of Response Time:

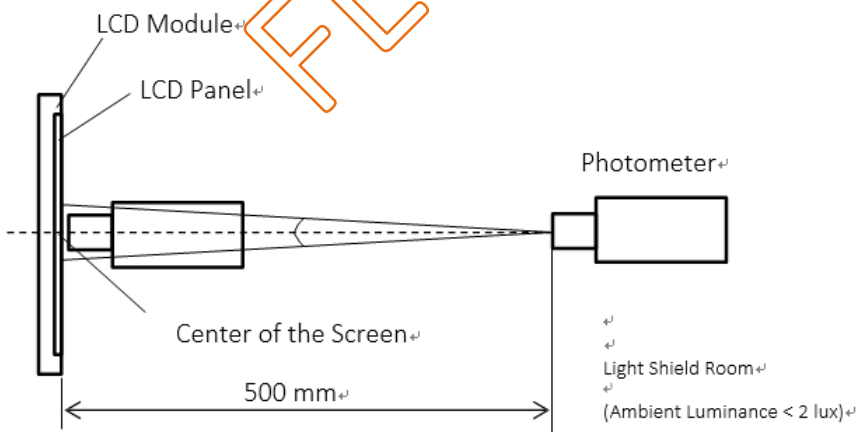
The response time is set initially by defining the “Rising Time (T_R)” and the “Falling Time (T_F)” respectively. Please refer the figure to the followings:



Note 4: Definition of Brightness (Lc)

Measure the center area of the panel and the viewing angle of the $\theta_x = \theta_y = 0^\circ$

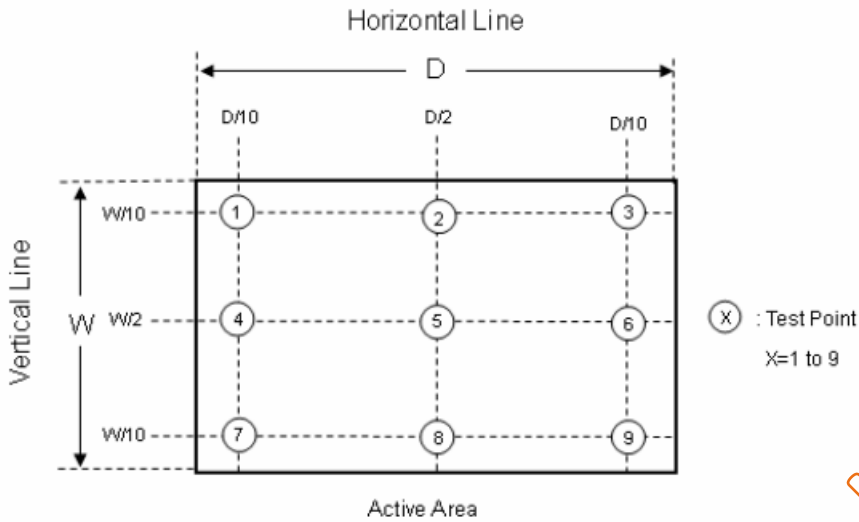
Note 5: The method of optical measurement:



Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4) \sim L(9)] / \text{Minimum} [L(1), L(2), L(3), L(4) \sim L(9)]$$



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B. Touch Screen specification

1. Environmental Specification

| Specification | Value | Remarks |
|-----------------------|--------------|---------|
| Operating Temperature | -20°C ~ 70°C | |
| Storage Temperature | -40°C ~ 80°C | |
| Operating Humidity | 20% ~ 90%RH | |
| Storage Humidity | 10% ~ 90%RH | |

2. Mechanical Specification

| Specification | Value |
|-------------------------------|-----------------------------------|
| Operating Life (Finger input) | 10 ⁷ times |
| Light Transmittance | >85% Min. (JIS K-7105) with glass |
| Surface hardness | 6H |
| FPC Peeling Force | 5N Max |

3. USB Type Controller

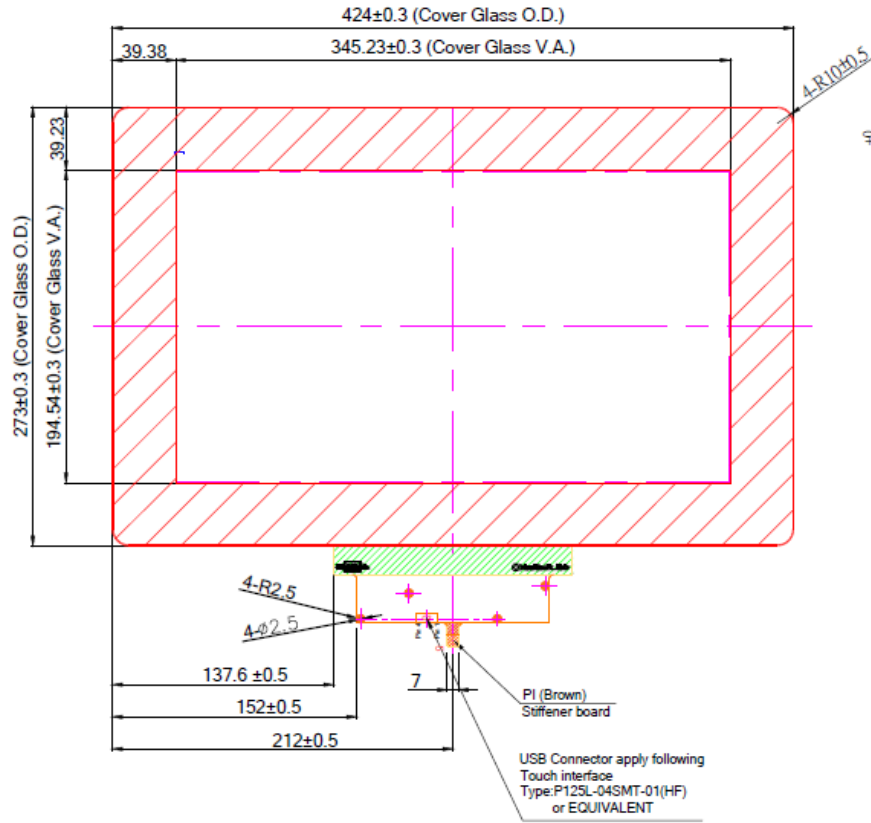
| Parameters | Features |
|---------------------------------|---|
| Circuit Board Dimension | Refer to drawings |
| Channels of Panel | Based on Sensor Design |
| Input Voltage | 5V for USB |
| Linearity(Note 1) | Single Line drawing accuracy : Up to 1pt +/- 1mm offset /10mm |
| | Single Touch (point) accuracy : Up to 1pt +/- 1mm |
| Interface | USB: 2.0(Below) Full Speed |
| Resolution | 4096×4096 resolution |
| Power consumption(mA) | Active Mode: <70mA |
| | Idle Mode : <55mA |
| | Sleep Mode :< 15mA |
| | (Operation Mode :Active Mode only) |
| Report rate(points/sec) Note(2) | > 100 Hz |
| Response time | Average < 25 ms |

Note (1): Depending by Sensor design and other parameters, Refer to Windows 8 Logo regulation if need to follow min spec

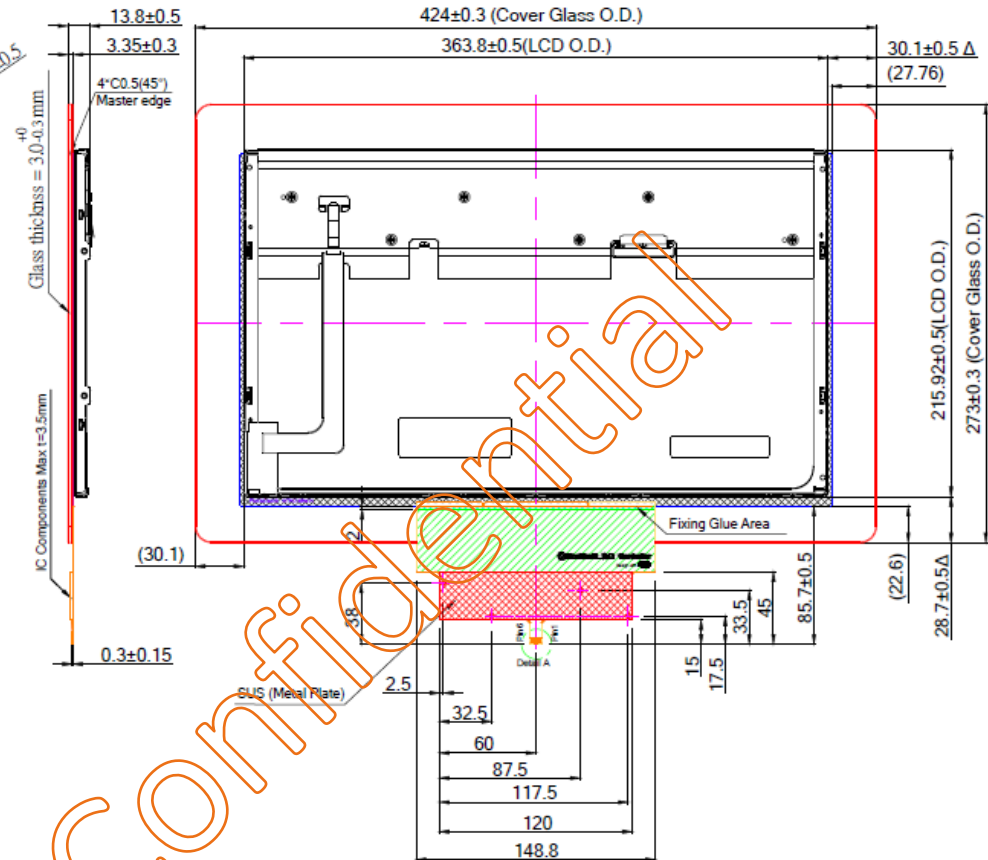
Note (2): Report rate will vary by channel number, cover thickness, number of fingers and other parameters

C. DIMENSION AND DRAWING

Front VIEW



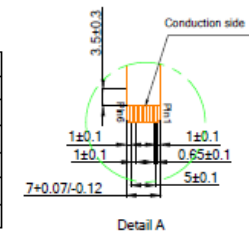
Back VIEW



Note:

1. Tolerance: ±0.5mm
2. Touch finger input or special conductive pen
3. Touch Surface Hardness: 6H (Semi Tempered Glass)
4. Touch Transmittance: >85% (JIS-K7105)
5. Touch Surface Treatment: None
6. If customer put a front cover all around need use at least 2mm thick gasket between touch and metal frame
7. USB max ripple acceptable is 50mV, in other case touch will not work correctly
8. Referring to the integration guide to avoid any integration noise issue
9. LCD model : FLC-156ITL2000SA1
10. Touch model : RTPC156W-H30BP1-U

| C2:Pin Define for USB 4 pin | | C1:USB Interface | |
|-----------------------------|-----|------------------|-----|
| Pin 01 | GND | Pin 01 | GND |
| Pin 02 | D- | Pin 02 | D- |
| Pin 03 | D+ | Pin 03 | D+ |
| Pin 04 | VDD | Pin 04 | VDD |
| | | Pin 05 | NC |
| | | Pin 06 | RST |



| Customer Approval | | Part Number | | FLD-156ITL20PUSA2 | |
|-------------------|------------------------|-------------|-------------|-------------------|-------------|
| Date | Rel. Date | Person | Description | | |
| Company | | | | | |
| Name | | | | | |
| Signature | Date | Design By | Date | Check By | Approved By |
| | First Drawing 20170821 | Kevin | | | |

D. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the module during assembly.
- Do not insert and plug out the input connector while the LCD panel is operating.
- Do not take apart the panel or frame from module assembly or insert anything into the backlight unit.
- Do not keep the same pattern in a long period of time, it may cause image sticking on LCD panel. Can use shuffle content periodically if fixed pattern is displayed on the screen.
- Do not touch the display area with bare hands, this will stain the display area.
- Pay attention to handle lead wire of backlight, that is not tugged in connect with LED driver.
- Do not change variable resistance settings in LCD panel, it may cause not satisfy of LCD characteristics specification.
- To avoid the static electricity to damage the CMOS LSI, the operator should be grounded when in contact with the LCD panel, and also to all electrical equipment.
- Need to follow the correct power frequency when LCD panel is connecting and operating, this can avoid damage to CMOS LSI during latch-up.
- Need to store the LCD panel indoor without the exposure of sunlight where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 60% RH.



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